

# PATENT COOPERATION TREATY


## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 10 MAR 2006

Applicant's or agent's file reference 031107PCT	<b>FOR FURTHER ACTION</b> See Form PCT/PEA/416	
International application No. PCT/JP2004/018081	International filing date (day/month/year) 29.11.2004	Priority date (day/month/year) 02.12.2003
International Patent Classification (IPC) or national classification and IPC INV. F02D41/02 F02D41/14		
Applicant TOYOTA JIDOSHA KABUSHIKI KAISHA et al.		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 2 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>		
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>		
Date of submission of the demand  22.09.2005	Date of completion of this report  10.03.2006	
Name and mailing address of the international preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer  Röttger, K  Telephone No. +31 70 340-3948	



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/JP2004/018081

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-32 as originally filed

**Claims, Numbers**

3-9 as originally filed  
1 filed with the demand

**Drawings, Sheets**

1/8-8/8 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☒ the claims, Nos. 2
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify)*:
  - ☐ any table(s) related to sequence listing *(specify)*:
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify)*:
  - ☐ any table(s) related to sequence listing *(specify)*:

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/JP2004/018081

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1, 3-9
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1, 3-9
Industrial applicability (IA)	Yes: Claims	1, 3-9
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/JP2004/018081

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

Reference is made to the following documents:

- D1: US 2002/116919 A1 (ROSEL GERD ET AL) 29 August 2002
- D2: WO 02/18034 A (VOLKSWAGEN AKTIENGESELLSCHAFT; POTT, EKKEHARD;  
ZILLMER, MICHAEL; LINDL) 7 March 2002
- D3: US-A-4 454 846 (SUZUKI ET AL) 19 June 1984
- D4: US-A-5 784 880 (TOSHIRO ET AL) 28 July 1998
- D5: PATENT ABSTRACTS OF JAPAN vol. 010, no. 265 (M-515), 10 September 1986 &  
JP 61 087935 A (TOYOTA MOTOR CORP), 6 May 1986

**Clarity (Article 6 PCT)**

The application does not meet the requirements of Article 6 PCT, because claim 1 is not clear.

Expressions like "until the second exhaust gas purifying catalyst becomes lean" and "to make the first exhaust gas purifying catalyst lean and not the enough to make the second exhaust gas purifying catalyst lean" do not have a specific meaning in the technical field. From the description it is apparent that the expression "make catalyst lean" relates to occluding oxygen in the catalyst until it reaches the maximum oxygen occlusion quantity (see description page 18, lines 24-26 and page 19, lines 14-20). This definition will be used in this opinion.

**Claim 1**

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not inventive in the sense of Article 33(3) PCT.

The document D1 discloses:

An air-fuel ratio control apparatus of an internal combustion engine comprising:

- a first exhaust gas purifying catalyst (5) disposed in an exhaust passage;
- a exhaust gas purifying second catalyst (6) disposed downstream of the first exhaust gas purifying catalyst ;

first air-fuel ratio acquiring means (7) provided upstream of the first catalyst (5), for acquiring an air-fuel ratio of exhaust gas;

second air-fuel ratio acquiring means (8) for acquiring an air-fuel ratio of the exhaust gas flowing into the second catalyst (6); and

air-fuel ratio controlling means (controlling unit 9) for controlling an air-fuel ratio in the internal combustion engine according to the air-fuel ratio acquired by the first air-fuel ratio acquiring means and the air-fuel ratio acquired by the second air-fuel ratio acquiring means;

wherein the air-fuel ratio controlling means comprises:

lean control means for controlling an air-fuel ratio in the internal combustion engine until the second exhaust gas purifying catalyst becomes lean (*both catalyst are filled with oxygen up to 100%, see paragraph 25*) after completion of a fuel quantity increasing operation of the internal combustion engine (*it is clear that this lean phase will follow a rich phase*); and

intermediate lean control means for performing, at least one time, control to change the air-fuel ratio in the internal combustion engine to a lean air-fuel ratio within the range enough to make the first exhaust gas purifying catalyst lean (*after transition from a rich-burn operation first catalyst 5 is fully loaded with oxygen*) and not enough to make the second exhaust gas purifying catalyst lean (*the amount of oxygen stored in the second catalyst 6 is brought to a target value (30-70%), see paragraph 7*) between the fuel quantity increasing operation and the air-fuel ratio control by the lean control means.

The subject-matter of claim 1 differs from this known apparatus in that the air-fuel ratio control by the lean control means is performed during idling. This however is well known in the state of the art, see e.g. the document D3 which was cited.

### **Dependent claims**

Dependent claims 3-9 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, see documents D1-D5 and the corresponding passages cited in the search report.

CLAIMS

1. (amended) An air-fuel ratio control apparatus of an internal combustion engine comprising:

a first exhaust gas purifying catalyst disposed in an exhaust passage;

a second exhaust gas purifying catalyst disposed downstream of the first exhaust gas purifying catalyst;

first air-fuel ratio acquiring means provided upstream of the first exhaust gas purifying catalyst, for acquiring an air-fuel ratio of exhaust gas;

second air-fuel ratio acquiring means for acquiring an air-fuel ratio of the exhaust gas flowing into the second exhaust gas purifying catalyst; and

air-fuel ratio controlling means for controlling an air-fuel ratio in the internal combustion engine according to the air-fuel ratio acquired by the first air-fuel ratio acquiring means and the air-fuel ratio acquired by the second air-fuel ratio acquiring means,

wherein the air-fuel ratio controlling means comprises:  
lean control means for controlling an air-fuel ratio in the internal combustion engine until the second exhaust gas purifying catalyst becomes lean after completion of a fuel quantity increasing operation of the internal combustion engine; and  
intermediate lean control means for performing, at least one time, control to change the air-fuel ratio in the internal combustion engine to a lean air-fuel ratio within the range enough to make the first exhaust gas purifying catalyst lean and not

enough to make the second exhaust gas purifying catalyst lean between the fuel quantity increasing operation and the air-fuel ratio control by the lean control means, and performs an air-fuel ratio control by the lean control means during an idle operation of the internal combustion engine.

2. (canceled)

3. The air-fuel ratio control apparatus of the internal combustion engine according to claim 1 or 2, wherein the air-fuel ratio controlling means performs an air-fuel ratio control by the intermediate lean control means during a substantially steady operation in a partial load region of the internal combustion engine.

4. The air-fuel ratio control apparatus of the internal combustion engine according to any one of claims 1 to 3, wherein the intermediate lean control means makes the air-fuel ratio in the internal combustion engine change to a lean air-fuel ratio by the smaller amount than the lean control means.

5. The air-fuel ratio control apparatus of the internal combustion engine according to any one of claims 1 to 4, wherein the air-fuel ratio controlling means does not perform any air-fuel ratio control by the lean control means and the intermediate